WE CLAIM:

1. In a process for the separation of a gas stream containing methane, $C_2$ components, $C_3$ components and heavier hydrocarbon components into a volatile residue gas fraction containing a major portion of said methane and a relatively less volatile fraction containing a major portion of said $C_2$ components, $C_3$ components and heavier hydrocarbon components, in which process

(a) said gas stream is treated in one or more heat exchange steps to produce at least a first feed stream that has been cooled under pressure;

(b) said cooled first feed stream is expanded to a lower pressure, and thereafter supplied to a fractionation tower at a top feed point; and

(c) said cooled expanded first feed stream is fractionated at said lower pressure whereby the components of said relatively less volatile fraction are recovered;

the improvement wherein

(1) a liquid distillation stream is withdrawn from said fractionation tower and heated;

(2) said heated distillation stream is returned to a lower point on said fractionation tower that is separated from said withdrawal point by at least one theoretical stage; and

(3) the quantities and temperatures of said feed streams to said fractionation tower are effective to maintain the overhead temperature of said fractionation tower at a temperature whereby the major portions of the components in said relatively less volatile fraction are recovered.

2. In a process for the separation of a gas stream containing methane, $C_2$ components, $C_3$ components and heavier hydrocarbon components into a volatile residue gas fraction containing a major portion of said methane and a relatively less volatile fraction containing a major portion of said $C_2$ components, $C_3$ components and heavier hydrocarbon components, in which process

(a) said gas stream is treated in one or more heat exchange steps and at least one division step to produce at least a first feed stream that has been cooled under pressure to condense substantially all of it, and at least a second feed stream that has been cooled under pressure;

(b) said substantially condensed first feed stream is expanded to a lower

pressure whereby it is further cooled, and thereafter directed in heat exchanger relation with a warmer distillation stream which rises from fractionation stages of a fractionation tower;

(c) said distillation stream is cooled by said first stream sufficiently to partially condense it, whereupon said partially condensed distillation stream is separated to provide said volatile residue gas fraction and a reflux stream, with said reflux stream thereafter supplied to said fractionation tower at a top feed point;

(d) said warmed first stream is supplied to said fractionation tower at a first mid-column feed point;

(e) said cooled second feed stream is expanded to said lower pressure, and thereafter supplied to said fractionation tower at a second mid-column feed point; and

(f) said reflux stream, said heated first feed stream, and said expanded second feed stream are fractionated at said lower pressure whereby the components of said relatively less volatile fraction are recovered;

the improvement wherein

(1) a liquid distillation stream is withdrawn from said fractionation tower and heated;

(2) said heated distillation stream is returned to a lower point on said fractionation tower that is separated from said withdrawal point by at least one theoretical stage; and

(3) the quantities and temperatures of said feed streams to said fractionation tower are effective to maintain the overhead temperature of said fractionation tower at a temperature whereby the major portions of the components in said relatively less volatile fraction are recovered.

3. The improvement according to claims 1 or 2 wherein said liquid distillation stream is pumped after being withdrawn from said fractionation tower.

4. The improvement according to claim 3 wherein

(a) said pumped liquid distillation stream is divided into at least a first portion and a second portion;

(b) said first portion is heated; and

(c) said heated first portion is returned to a lower point on said fractionation tower that is separated from said withdrawal point by at least one theoretical stage.

5. The improvement according to claims 1 or 2 wherein said liquid distillation stream is directed in heat exchange relation with at least a portion of said gas stream or said feed streams, to supply said cooling thereto and thereby heat said liquid distillation stream.

6. The improvement according to claim 3 wherein said pumped liquid distillation stream is directed in heat exchange relation with at least a portion of said gas stream or said feed streams, to supply said cooling thereto and thereby heat said pumped liquid distillation stream.

7. The improvement according to claim 4 wherein said first portion is directed in heat exchange relation with at least a portion of said gas stream or said feed streams, to supply said cooling thereto and thereby heat said first portion.

8. The improvement according to claims 1 or 2 wherein the quantity and temperature of said heated distillation stream and the heating supplied to said fractionation tower are effective to maintain the bottom temperature of said fractionation tower at a temperature to reduce the quantity of carbon dioxide contained in said relatively less volatile fraction.

9. The improvement according to claim 3 wherein the quantity and temperature of said heated distillation stream and the heating supplied to said fractionation tower are effective to maintain the bottom temperature of said fractionation tower at a temperature to reduce the quantity of carbon dioxide contained in said relatively less volatile fraction.

10. The improvement according to claim 4 wherein the quantity and temperature of said heated first portion and the heating supplied to said fractionation tower are effective to maintain the bottom temperature of said fractionation tower at a temperature to reduce the quantity of carbon dioxide contained in said relatively less volatile fraction.

11. The improvement according to claim 5 wherein the quantity and temperature of said heated distillation stream and the heating supplied to said fractionation tower are effective to maintain the bottom temperature of said fractionation tower at a temperature to reduce the quantity of carbon dioxide contained in said relatively less volatile fraction.

12. The improvement according to claim 6 wherein the quantity and temperature of said heated distillation stream and the heating supplied to said fractionation tower are effective to maintain the bottom temperature of said fractionation tower at a temperature to reduce the quantity of carbon dioxide contained in said relatively less volatile fraction.

13. The improvement according to claim 7 wherein the quantity and temperature

of said heated first portion and the heating supplied to said fractionation tower are effective to maintain the bottom temperature of said fractionation tower at a temperature to reduce the quantity of carbon dioxide contained in said relatively less volatile fraction.